THURSDAY, JULY 13, 1916.

BRITISH MARINE ANNELIDS.

A Monograph of the British Marine Annelids. Vol. iii., part i. Text. Polychæta: Opheliidæ to Ammocharidæ. By Prof. W. C. McIntosh. Pp. viii+368. Also vol. iii., part ii. Plates lxxxviii–cxi. (London: Dulau and Co., Ltd., 1915.) Price 25*s.* net each volume.

THE first part of the first volume of this monograph of British Annelids dealt with the Nemertine worms. The second part of the first volume, the two parts of the second volume, and now the third volume are devoted to the Chætopoda, and still the great work is incomplete. At least one more volume will be required before the order Polychæta is finished.

The third volume includes those families that were grouped together by Benham in the sub-orders Spioniformia, Capitelliformia, and Scoleciformia, together with the family Cirratulidæ of the sub-order Terebelliformia.

The author has not adopted in his monograph any system of grouping the families into sub-orders such as that suggested by Benham, and it is rather awkward for the zoologist who is not a specialist in the Chætopoda and does not know the sequence of families which Prof. McIntosh employs that he has no guide to the position in the three volumes of any family he wishes to study, nor a list of those that have still to be described.

No doubt the author will prepare a tabular statement of the classification of the order for the last volume, but it would have been a great convenience if he had included in each part a list of all the families arranged in the order of their treatment.

We make this comment in the first place because the monograph is on a much higher plane than many of the systematic treatises on zoology with which we are acquainted, and it is important in the interests of science that everything should be done to facilitate its use.

The present volume includes many of the most important of the marine worms, such as the Arenicola (or lug-worm of the fisherman), the phosphorescent Chaetopterus, the Spionidæ, the rock-boring Polydora, and the morphologically interesting forms Magelona and Capitella. In studying the chapters on these important worms the reader must be impressed not only by the vast amount of labour and learning bestowed upon their systematic treatment, but also by the author's generous appreciation of the anatomical, physiological, and embryological knowledge concerning them that has accumulated during recent years. It is clearly shown on every page that infinite pains have been taken with the tedious but necessary and valuable work of completing the lists of synonyms and references to species; but intimate knowledge and life-long research have also been employed in summarising what is known of the morphology of the species described. The monograph stands, therefore, as an important contribution to our general knowledge of the order as a whole, as well as a descriptive catalogue of the species that inhabit the British sea area. It is a standard work of the highest importance, and we may be proud of it as a product of British science.

It is unfortunate that our final judgment of the illustrations must be suspended. Six of the twenty-four plates that illustrate part ii. of this volume were to have been issued in colours, but in consequence of the war they have not yet been delivered, and to prevent further delay in publication uncoloured copies have been substituted for them. This is undoubtedly a serious misfortune, and we may cordially extend to Prof. McIntosh our good wishes that in the coming times of peace the coloured plates may be recovered. In the meantime, however, we may say that, apart from this drawback, the illustrations are at least equal to the very high standard attained by those of the earlier volumes, and add immensely to the value of the monograph. S. J. H.

COLLOIDAL SOLUTIONS.

The Physical Properties of Colloidal Solutions. By Prof. E. F. Burton. Pp. vii+200. (London: Longmans, Green, and Co., 1916.) Price 6*s.* net.

THIS work forms one of the series of monographs on physics edited by Sir J. J. Thomson, and it is perhaps natural that the author should have practically confined himself to discussing that class of colloidal solutions which has so far proved amenable to quantitative and mathematical investigation—the class known as suspensoids. The treatment of the emulsoids is very brief and inadequate, an omission all the more striking as the author several times insists on the importance of colloidal physics to the arts and to biology and physiology, the former of which are largely, and the latter exclusively, concerned with emulsoids.

Within these limits, however, the treatment is full and very clear. The chapter on preparation and classification gives all that is necessary in a small compass. In that on the ultramicroscope the author has gone a good deal further than is usual, and perhaps necessary, by including a brief account of the principal theories of image formation and resolving power. The chapters dealing with the theory of the Brownian movement—to the physicist the crowning achievement of colloidal science—are admirable and give the best historical account, as well as the clearest presentation, of the mathematical work of Einstein, v. Smoluchowski, Langevin, and Perrin at present available in any text-book. The optical properties are also treated with unusual fulness, while the electrical ones receive ample, but not excessive, attention. The frank confession—which probably only one of the best-known workers in this much-tilled field can afford to make—that the stability of sols is still a puzzle is to be welcomed. Adsorption is only touched upon as bearing upon electrolyte coagulation, and the statement that the adsorption isotherm

©1916 Nature Publishing Group

approaches a line parallel to the C-axis "asymptotically" is certainly surprising, if Freundlich's equation is accepted as correct.

An agreeable feature of the book is the amount of space devoted to presenting the historical development of different branches of the subject, many quotations from the original papers of pioneer workers being given. In this connection the author fixes 1750 as the earliest date at which gold sols had been obtained by reduction. "Aurum potabile," however—a red liquid prepared by reducing gold chloride with oil of rosemary and undoubtedly a gold sol—had considerable vogue as a medicine much before that time, being mentioned, *e.g.*, by John Evelyn in his diary under the date June 27, 1653.

The references to literature—given at the end of each chapter—are copious, and names and subject matter are well indexed. The book may be thoroughly recommended to the large class of students to whom a knowledge of colloidal science is becoming increasingly necessary; to cover the whole field it should be supplemented by a volume dealing with emulsoid sols and gels, which latter in particular are systems quite as fascinating, and certainly as important, as sols.

MATHEMATICAL PAPERS AND ADDRESSES.

(1) *Proceedings of the London Mathematical Society.* Second Series. Vol. xiv. Pp. xxxviii+480. (London: F. Hodgson, 1915.) Price 25*s.*

(2) *Four Lectures on Mathematics.* Delivered at Columbia University in 1911 by Prof. J. Hadamard. Pp. v+52. (New York: Columbia University Press, 1915.)

(1) A VOLUME of the L.M.S. Proceedings is not only a permanent record of achievement. At its first appearance it is a useful index of the state of English mathematics at the time; and it also, from year to year, suggests the appearance of new stars in the mathematical firmament. It may be not without significance that, in the present volume, there is a first contribution (we believe) by a Japanese gentleman, and another by an Indian fellow-subject. Unless we are greatly mistaken, or unkindly fate should intervene, Mr. S. Ramanujan is likely to become an arithmetician of the first rank. At any rate, his paper on highly composite numbers is original, profound, and ingenious, and shows complete mastery of the new methods and notation inaugurated by Landau. Mr. Tadahiko Kubota provides one of the two papers in the volume which have any claim to be called geometrical, and of these it is the more truly such. Under certain assumptions, most of which are explicit, or nearly so, he proves the following theorem: "If a closed convex surface be cut by every pencil of parallel planes in homothetic curves, it is an ellipsoid." The method of proof consists mainly in showing that such a surface defines a polar field precisely similar to that which is determined by an ellipsoid. The comparative simplicity of the demonstration is very remarkable.

The other geometrical paper, by Mr. E. H. Neville, was suggested by the racecourse puzzle of covering a circle by a set of five circular discs. Unfortunately, the solution depends upon four simultaneous trigonometrical equations, and as these are treated analytically, the paper has only a tinge of geometrical theory. Once more we must express our regret that English mathematics is so predominatingly analytical. Cannot someone, for instance, give us a truly geometrical theory of Poncelet's poristic polygons, or of Staude's thread-constructions for conicoids?

The other papers cover a wide range, from group-theory at one end (Prof. Burnside) to tide-theory at the other (Prof. Larmor). One of the most important, in our opinion, is that of Mr. and Mrs. W. H. Young on the reduction of sets of intervals—one of the many notable extensions of the famous Heine-Borel theorem. It would be foolish to try to give a detailed estimate of all the twenty-six papers.

Prof. Love's address on mathematical research is bright as well as stimulating, and many of his crisp sayings deserve the most careful attention; for example, his remarks on exact solutions of physical problems, on the difficulty of applying the general theory of ordinary linear differential equations, on "curiosity," on the danger of being overwhelmed by the mass of literature, and so on. We wish we could agree with his unqualified assertion that "text-books and treatises include always later additions to knowledge"; perhaps he regards productions that do not conform to this statement as mere samples of those "books that are no books" to which Lamb refers. Lastly, we may note that Prof. Love attaches due importance to mathematical style in composition. This is too often neglected; simplicity, clearness, and appropriate notation ought, at any rate, to be aimed at with all possible diligence. We rejoice, too, that in this connection he boldly and truly says that a mathematical book or paper is (or should be) a work of art.

(2) The United States have been pioneers in the practice, now common, of inviting eminent foreigners to give occasional lectures, or courses of lectures, on their chosen subject; we do not refer to lectures or addresses on ceremonial occasions. Prof. J. Hadamard is renowned for his original researches in function-theory; in the present short course of four lectures he deals with the bearings on physics of various types of equations (differential, integral, integro-differential), and, in a minor degree, of topology (*analysis situs*). It is needless to say that they are highly suggestive and valuable; their defect, such as it is, is that in trying to cover a wide field the author is obliged to be very concise, and in some cases this leads to obscurity. As an example of what we mean, take p. 34. Substantially (unless we mistake the author's intention), Prof. Hadamard wishes to point out that physical problems which have the same analytical solution lead to different interpretations of the solution,

©1916 Nature Publishing Group